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PART V

ENVIRONMENTAL PROTECTION AGENCY

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Electric Utility Steam Generating Units; Additional Information

[6560-01-M]

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 1022-6]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Electric Utility Steam Generating Units; Additional Information

AGENCY: Environmental Protection Agency.

ACTION: Additional Information on Proposed Rule.

SUMMARY: On September 19, 1978 (43 FR 42154), EPA proposed standards of performance which would limit emissions of sulfur dioxide (SO_2), particulate matter, and nitrogen oxides (NO_x) from new, modified, and reconstructed electric utility steam generating units capable of combusting more than 73 megawatts (MW) heat input (250 million Btu/hour) of fossil fuel. In that proposal, EPA indicated that a final decision on full versus partial SO_2 scrubbing would not be made until the analyses of various alternatives were completed and public comments evaluated. The purpose of this notice is to advise the public of the preliminary results of additional analyses that have been undertaken since September 19, 1978. It should be noted that these results have not been fully reviewed by the EPA technical staff, nor have the alternative standards undergone policy review by the Agency.

DATES: Comments on this information may be submitted to EPA through January 15, 1979.

ADDRESSES: Comments should be submitted to Mr. Jack R. Farmer, Chief, Standards Development Branch, Emission Standards and Engineering Division (MD-13), Environmental Protection Agency, Research Triangle Park, North Carolina 27711.

FOR FURTHER INFORMATION CONTACT:

Mr. Don R. Goodwin, Director, Emission Standards and Engineering Division (MD-13), Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541-5271.

SUPPLEMENTAL INFORMATION: Since revisions to the standards of performance for power plants were proposed on September 19, 1978, EPA has conducted additional analyses in order to identify the economic, environmental, and energy impacts associated with various alternative sulfur dioxide standards. As part of this effort, the EPA staff met with representatives of the Department of Energy, Council of Economic Advisors, Council on Wage and Price Stability, and others for the purpose of reexamining the assumptions used for the August analysis and to develop alternative forms of the standard for analysis. As a result, certain assumptions were changed and a number of new regulatory alternatives were defined. EPA again employed the economic model that was used in August to project the national and regional impacts associated with each alternative considered.

Impacts Analyzed

The environmental impacts of the alternative standards were examined by projecting pollutant emissions. Sulfur dioxide emissions were estimated nationally and by geographic region for each plant type, fuel type, and age category. EPA has also estimated the quantity of flue gas desulfurization (FGD) sludge generated by the various alternatives considered.

The economic and financial effects of the alternatives were examined in terms of capital and annualized costs. This assessment included an estimation of the utility capital expenditures for new plant and pollution control equipment as well as the fuel costs and operating and maintenance expenses associated with the plant and equipment. The impact on consumers was determined by analyzing the effect of the alternatives on average monthly residential bills. The alternatives were also examined in terms of cost per ton of SO_2 removed. Finally, an estimate was made of the present value of utility revenue requirements for the various alternatives.

The effects of the alternative standards on energy production and consumption were also analyzed. National coal use was projected in terms of production and consumption by geographic region. The amount of Western coal shipped to the Midwest and East was also estimated. In addition, utility consumption of oil and gas was analyzed.

Major Assumptions

A number of changes have been made in the assumptions which will have an effect on the results of the analyses. The assumptions changed from the August analysis are summarized in Table 1 and are discussed below.

After conferring with appropriate Federal agencies, it was concluded that the oil prices assumed in the August analysis were too high. On the other hand, no firm guidance was available as to what oil prices should be used. In view of this, EPA decided that the best course of action was to use two sets of oil prices which reflect the best estimates of those governmental entities concerned with projecting future oil prices. It was EPA's intention to model each regulatory alternative considered with both sets of oil prices. Unfortunately, the results from the analysis incorporating the lower of the two new oil prices were not completed in time to be included in this notice. A summary will be presented at the Public Hearing on December 12, 1978.

Reassessment of the assumptions made in the August analysis also revealed that the impact of the coal washing credit had not been considered in the modeling analysis. Other credits allowed by the September proposal, such as sulfur removed by the pulverizers or in bottom ash and flyash, were determined not to be significant when viewed at the national and regional levels. The coal washing credit, on the other hand, was found to have a significant effect on predicted emissions levels and, therefore, was taken into consideration in the results presented here.

As a result of this reassessment, refinements also have been made in the flue gas desulfurization (FGD) costs assumed. These refinements include changes in sludge disposal costs, energy penalties calculated for reheat, and module sizing. In addition, an error was corrected in the calculation of partial scrubbing costs. These changes have resulted in relatively higher partial scrubbing costs when compared to full scrubbing.

Changes have been made in the FGD availability assumption also. Previous analyses assumed 100 percent availability of FGD systems. This assumption was in conflict with EPA's estimates on module availability. In view of this, three selected alternatives in the current analyses were analyzed at a lower system availability consistent with a 90 percent availability for individual modules when the system is equipped with one spare. EPA believes that the new approach better reflects the performance of well designed, operated, and maintained FGD systems. However, in order to expedite the analyses, all the alternatives were initially analyzed with an assumed system availability of 100 percent.

Additional refinements included a change in the capital charge rate for pollution control equipment to conform to the Federal tax laws on depreciation, and the addition of 100 million tons of coal reserves not previously accounted for in the model.

Finally, a number of less significant adjustments were made. These included adjustments in nuclear capacity to reflect a cancellation of a plant, consideration of oil consumption in transporting coal, and the adjustment of costs to 1978 dollars rather than 1975 dollars. It should be understood that

all costs include the costs of complying with the proposed particulate standard and nitrogen oxide standards, as well as the sulfur dioxide alternatives.

Description of Alternatives Analyzed

This section presents a description of the alternatives analyzed since the September 19 proposal. The short title on each alternative corresponds to the column headings used in the tables which follow. In structuring alternatives, a range of options was developed as a means of assessing the impacts of emission control requirements which are both more and less stringent than those identified in the September proposal. These alternatives, which are described below, include three full scrubbing options requiring 90 percent control, one full scrubbing option requiring 95 percent control, seven partial scrubbing options, and three sensitivity runs. In addition, EPA undertook analyses of alternatives specified by the Utility Air Regulatory Group (UARG) and the Natural Resources Defense Council (NRDC). A preliminary review of the results revealed that certain errors were made in the modeling specifications for the UARG and NRDC alternatives. As a result, the cases actually modeled did not conform to specifications provided by UARG and NRDC. Therefore, EPA is reanalyzing these alternatives and will release the results as soon as they are available.

In view of the wide variety of alternatives considered since the proposal, all standards are presented as annual average emission limitations in order to provide a common basis for comparison. In the analysis presented in September, all standards were described in terms of 24-hour averages, but were converted to annual averages for modeling purposes. This conversion was necessary because the model requires emission standards to be expressed in terms of annual averages, which can be substantially different from standards based on other averaging times. For example, because of the variability in outlet sulfur emissions, EPA has determined that an annual emission rate of 0.8 lb SO_2/million Btu heat input would be required to comply with a 24-hour emission rate of 1.2 lb SO_2/million Btu heat input (with three exemptions per month). The use of annual average descriptors should not be construed to mean that EPA has made a final decision regarding averaging periods.

A. FULL CONTROL ALTERNATIVES

1. *90 Percent Control With 340 ng/J Limit*—This alternative corresponds to the full control alternative proposed in September. For modeling purposes, this alternative is specified as 90 percent reduction in potential SO_2 emissions with a 340 ng/J (0.8 lb SO_2/million Btu) heat input maximum allowable emission limitation. Credit toward the 90 percent reduction requirement is allowed for any sulfur removed through coal washing. However, the maximum allowable emission limitation precludes the application of the full coal washing credit when certain high-sulfur coals are fired.

2. *90 Percent Control With 240 ng/J Limit*—This alternative corresponds to the one described above except that a lower maximum allowable emission limit of 240 ng/J (0.55 lb SO_2/million Btu) heat imput is specified. In the model, the maximum allowable emission limitation precludes coals greater than 2150 ng/J (5.0 lb SO_2/million Btu) heat input after washing.

3. *90 Percent Reduction Across Scrubber*—This alternative requires a 90 percent efficient scrubber. A maximum allowable emission limitation of 340 ng/J (0.8 lb SO_2/million Btu) heat input is also specified.

B. PARTIAL CONTROL ALTERNATIVES

4. *240 ng/J Emission Limit*—This alternative has a maximum allowable emission limitation of 240 ng/J (0.55 lb SO_2/million Btu) heat input with a minimum requirement of 33 percent reduction in potential SO_2 emissions. This results in varying control requirements ranging from 33 percent on low-sulfur coals to 90 percent for high-sulfur coals. In the model, the maximum allowable emission limitation precludes coals greater than 2150 ng/J (5.0 lb SO_2/million Btu) heat input.

5. *90 Percent Control With 330 ng/J Maximum Control*—This alternative requires 90 percent control of potential SO_2 emissions with a maximum allowable emission limit of 340 ng/J (0.8 lb SO_2/million Btu) heat input. The maximum control level is 330 ng/J (0.77 lb SO_2/million Btu) heat input, but a minimum of 22 percent reduction in potential SO_2 emissions is required. The 330 ng/J (0.77 lb SO_2/million Btu) heat input maximum control level will allow partial scrubbing on coals below about 1510 ng/J (3.5 lb SO_2/million Btu) heat input.

6. *Sliding Scale With 90 Percent Control in West*—This option requires 90 percent control of potential SO_2 emissions in the eleven western-most States. Partial scrubbing is allowed in the remaining States. The partial scrubbing standard is a sliding scale emission control requirement based on the sulfur content of coal burned. The scale slides from 50 percent control of potential SO_2 emissions for low-sulfur coal up to 90 percent control on high-sulfur coals. In the model, the maximum allowable emissions limitation precludes coals greater than 2150 ng/J (5.0 lb SO_2/million Btu) heat input.

7. *240 ng/J Standard With 90 Percent Control in West*—This option corresponds to the one above except that the partial scrubbing standard for Eastern States has been modified. The modified partial scrubbing standard is a uniform emission limit of 240 ng/J (0.55 lb SO_2/million Btu) heat input with a minimum control requirement of 33 percent reduction in potential SO_2 emissions (same standard as option 4 above). In the model, the maximum allowable emission limitation precludes coals greater than 2150 ng/J (5.0 lb SO_2/million Btu) heat input.

8. *90 Percent Control With 150 ng/J Maximum Control*—This alternative requires 90 percent control of potential SO_2 emissions with a maximum allowable emission limit of 260 ng/J (0.6 lb SO_2/million Btu) heat input. The maximum control level is 150 ng/J (0.35 lb SO_2/million Btu) heat input with a minimum requirement of 22 percent reduction in potential SO_2 emissions. The 150 ng/J (0.35 lb SO_2/million Btu) heat input maximum control level will allow partial scrubbing on coals below about 780 ng/J (1.8 lb SO_2/million Btu) heat input.

9. *90 Percent Control With 240 ng/J Maximum Control*—This alternative requires 90 percent control of potential SO_2 emissions with a maximum allowable emission limit of 24 ng/J (0.8 lb SO_2/million Btu heat input. The maximum control level is 240 ng/J (0.55 lb SO_2/million Btu) heat input with a minimum control requirement of 33 percent reduction in potential SO_2 emissions. The 240 ng/J (0.55 lb SO_2/million Btu) heat input maximum control level will allow partial scrubbing on coals below about 800 ng/J (2.8 lb SO_2/million Btu) heat input.

10. *Sliding Scale With 520 ng/J Limit*—This alternative is a sliding scale percent removal requirement based on the sulfur content of coal burned. The percent removal requirement varies from 20 percent on low-sulfur coal to 82 percent on high-sulfur coal. The maximum allowable emission limit is 520 ng/J (1.2 lb SO_2/million Btu) heat input.

C. 95 PERCENT CONTROL WITH 340 NG/J LIMIT

This alternative requires 95 percent control of potential SO_2 emissions. A maximum allowable emission limitation of 340 ng/J (0.8 SO_2/million Btu) heat input is specified.

In addition to different emission control requirements, this case contains a cost assumption that varies from all the other cases being analyzed. It assumes that flue gas desulfurization (FGD) systems can achieve a 95 percent control efficiency annually with the use of scrubber slurry additives such as adipic acid. It was as-

sumed that the cost of such additives will be offset by a reduction in lime/limestone use. Since the cost of the additive handling equipment is small relative to total FGD costs, the same set of FGD cost functions was used as those for costing the 90 percent efficient scrubbers assumed for the other alternatives. Finally, it was assumed that the costs of building and operating scrubbers would decline over time as a result of design improvements and competitive forces in the marketplace. Costs were assumed to decline to two-thirds of the current cost in 1985 and one-half of current cost in 1990.

D. AVAILABILITY ANALYSES

As indicated earlier, several alternatives were analyzed with scrubber system availabilities consistent with 90 percent availability for individual FGD modules. In a manner consistent with the emergency by-pass provision of the September proposal, the analyses assumed a mix of load-shifting and by-pass around the scrubber during periods when the scrubber was not available for use. These analyses were performed for the following two full scrubbing alternatives and one partial control alternative, each of which has been described above:

90 Percent Control With 240 ng/J Limit
90 Percent Control Across Scrubber
240 ng/J Emission Limit

SUMMARY OF RESULTS

The results of these analyses are presented in Tables 2-8. It should be noted that these are preliminary results that have not been fully reviewed by technical staff and therefore may have to be changed to correct computational errors. In addition, the alternatives presented have not undergone policy review by the Agency. Therefore, it should not be construed that the EPA has made any decision regarding the final form of the SO_2 standard. The results of these analyses are being released at this time in order to provide the public with information on a wide range of alternatives at the earliest possible time.

The summary results of the analyses, which were used to prepare this notice, have been compiled and are available in the public record (Docket No. OAQPS-78-1). A detailed report, including a description of the alternatives and modeling results as well as regional data, will be prepared and placed in the record by January when all of the alternatives and sensitivity analyses have been completed.

Persons may comment on these results at the Public Hearing scheduled for December 12, 13, and 14 in Washington, D.C. Interested persons also will be afforded an opportunity to submit written comments on the results of these analyses and their underlying assumptions through January 15, 1978.

Dated: December 6, 1978.

EDWARD F. TUERK,
Acting Assistant Administrator for Air, Noise, and Radiation.

[6560-01-C]

Table 1. COMPARISON OF ASSUMPTIONS
August 1978 and November 1978

Assumption	August	November
Growth rates	1975-1985: 4.8%/yr 1985-1995: 4.0%	same same
Nuclear capacity	1985: 97 GW 1990: 165 1995: 230	same 1990: 165 GW 1995: 228
Oil prices ($ 1975)		Run 1 / Run 2
	1985: $15/bbl 1990: $20 1995: $28	1985: $12.90/bbl / $12.30/bbl 1990: $16.40 / $13.20 1995: $21.00 / $14.90
General inflation rate	5.5%/yr	same
Coal transportation	Increases at general inflation rate plus 1%	same
Coal mining labor costs	U.M.W. settlement and 1% real increase thereafter	same
Capital charge rate	10%	12.5%
Cost reporting basis	1975 dollars	1978 dollars
Coal cleaning credit	No	Yes
FGD Costs	--	Refined

Table 2A. NATIONAL 1990 SO_2 EMISSIONS FROM UTILITY BOILERS WITH 100 PERCENT FGD RELIABILITY[a]
(million tons)

Plant Category	Level of Control				
			Full Control		
	1975 Actual	Current Standards	90% Control With 340 ng/J Limit	90% Control With 240 ng/J Limit	90% Control Across Scrubber
SIP/NSPS Plants[b]	--	16.1	16.4	16.5	16.5
New Plants[c]	--	3.6	1.6	1.2	1.1
Oil Plants	--	1.8	1.9	1.9	1.9
Total National Emissions	18.6	21.5	19.9	19.6	19.5
Total Coal Capacity (GW)	198	406	391	390	390

[a]Results of joint EPA/DOE analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]Plants subject to existing State regulations or the current NSPS of 1.2 lb SO_2/million Btu.

[c]Plants subject to the revised standards.

Table 2B. NATIONAL 1990 SO_2 EMISSIONS FROM UTILITY BOILERS WITH 100 PERCENT FGD RELIABILITY[a]
(million tons)

Plant Category	Level of Control					
			Partial Control			
	1975 Actual	Current Standards	240 ng/J Emission Limit	90% Control With 330 ng/J Max. Control	Sliding Scale With 90% Control in West	240 ng/J Std. With 90% Control in West
SIP/NSPS Plants[b]	--	16.1	16.5	16.4	16.5	16.4
New Plants[c]	--	3.6	1.6	2.2	1.3	1.4
Oil Plants	--	1.8	1.9	1.8	1.9	1.9
Total National Emissions	18.6	21.5	20.0	20.4	19.7	19.7
Total Coal Capacity (GW)	198	406	399	401	394	398

[a]Results of joint EPA/DOE analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]Plants subject to existing State regulations or the current NSPS of 1.2 lb SO_2/million Btu.

[c]Plants subject to the revised standards.

Table 2C. NATIONAL 1990 SO_2 EMISSIONS FROM UTILITY BOILERS WITH 100 PERCENT FGD RELIABILITY[a]
(million tons)

Plant Category	Level of Control					
			Partial Control			
	1975 Actual	Current Standards	90% Control With 150 ng/J Max. Control	90% Control With 240 ng/J Max. Control	Sliding Scale With 390 ng/J Limit	95% Control With 520 ng/J Limit
SIP/NSPS Plants[b]	--	16.1	16.6	16.5	16.2	16.4
New Plants[c]	--	3.6	1.3	1.9	3.1	0.8
Oil Plants	--	1.8	1.9	1.9	1.8	1.8
Total National Emissions	18.6	21.5	19.8	20.3	21.1	19.0
Total Coal Capacity (GW)	198	406	396	399	401	400

[a]Results of joint EPA/DOE analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]Plants subject to existing State regulations or the current NSPS of 1.2 lb SO_2/million Btu.

[c]Plants subject to the revised standards.

Table 2D. NATIONAL 1990 SO_2 EMISSIONS FROM UTILITY BOILERS WITH 90 PERCENT FGD RELIABILITY[a]
(million tons)

Plant Category	Level of Control				
			Full Control		Partial Control
	1975 Actual	Current Standards	90% Control With 240 ng/J Limit	90% Control Across Scrubber	240 ng/J Emission Limit
SIP/NSPS Plants[b]	--	16.1	16.5	16.5	16.6
New Plants[c]	--	3.6	1.2	1.1	1.6
Oil Plants	--	1.8	2.0	2.0	1.9
Total National Emissions	18.6	21.5	19.7	19.6	20.1
Total Coal Capacity (GW)	198	406	388	388	397

[a]Results of joint EPA/DOE analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]Plants subject to existing State regulations or the current NSPS of 1.2 lb SO_2/million Btu.

[c]Plants subject to the revised standards.

Table 3A. REGIONAL 1990 SO_2 EMISSIONS FROM UTILITY BOILERS WITH 100 PERCENT FGD RELIABILITY[a]
(million tons)

	Level of Control				
			Full Control		
	1975 Actual	Current Standards	90% Control With 340 ng/J Limit	90% Control With 240 ng/J Limit	90% Control Across Scrubber
Total National Emissions	18.6	21.5	19.9	19.6	19.5
Regional Emissions					
East[b]	--	7.0	6.6	6.4	6.4
East South Central[c]	--	3.2	3.0	2.9	2.9
Midwest[d]	--	5.4	5.5	5.5	5.5
Great Plains[e]	--	2.4	2.3	2.3	2.3
West South Central[f]	--	2.2	1.6	1.6	1.6
West[g]	--	1.3	0.9	0.9	0.9
Total Coal Capacity (GW)	198	406	391	390	390

[a]Results of joint EPA/DOE analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]New England, Middle Atlantic, and South Atlantic Census Regions.

[c]East South Central Census Region.

[d]East North Central Census Region.

[e]West North Central Census Region.

[f]West South Central Census Region.

[g]Mountain and Pacific Census Regions.

Table 3B. REGIONAL 1990 SO_2 EMISSIONS FROM UTILITY BOILERS WITH 100 PERCENT FGD RELIABILITY[a]
(million tons)

	Level of Control					
			Partial Control			
	1975 Actual	Current Standards	240 ng/J Emission Limit	90% Control With 330 ng/J Max. Control	Sliding Scale With 90% Control in West	240 ng/J Std. With 90% Control in West
Total National Emissions	18.6	21.5	20.0	20.4	19.7	19.7
Regional Emissions						
East[b]	--	7.0	6.4	6.6	6.4	6.4
East South Central[c]	--	3.2	2.9	3.0	2.9	2.9
Midwest[d]	--	5.4	5.5	5.5	5.4	5.4
Great Plains[e]	--	2.4	2.4	2.4	2.5	2.4
West South Central[f]	--	2.2	1.8	1.9	1.7	1.8
West[g]	--	1.3	1.0	1.1	0.9	0.9
Total Coal Capacity (GW)	198	406	399	401	394	398

[a]Results of joint EPA/DOE analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]New England, Middle Atlantic, and South Atlantic Census Regions.

[c]East South Central Census Region.

[d]East North Central Census Region.

[e]West North Central Census Region.

[f]West South Central Census Region.

[g]Mountain and Pacific Census Regions.

Table 3C. REGIONAL 1990 SO_2 EMISSIONS FROM UTILITY BOILERS WITH 100 PERCENT FGD RELIABILITY[a]
(million tons)

	Level of Control					
			Partial Control			
	1975 Actual	Current Standards	90% Control With 150 ng/J Max. Control	90% Control With 240 ng/J Max. Control	Sliding Scale With 390 ng/J Limit	95% Control With 520 ng/J Limit
Total National Emissions	18.6	21.5	19.8	20.3	21.1	19.0
Regional Emissions						
East[b]	--	7.0	6.4	6.5	6.9	6.2
East South Central[c]	--	3.2	2.9	3.0	3.2	2.8
Midwest[d]	--	5.4	5.6	5.6	5.5	5.5
Great Plains[e]	--	2.4	2.3	2.4	2.4	2.2
West South Central[f]	--	2.2	1.6	1.7	2.0	1.5
West[g]	--	1.3	1.0	1.0	1.2	0.8
Total Coal Capacity (GW)	198	406	396	399	401	400

[a]Results of joint EPA/DOE analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]New England, Middle Atlantic, and South Atlantic Census Regions.

[c]East South Central Census Region.

[d]East North Central Census Region.

[e]West North Central Census Region.

[f]West South Central Census Region.

[g]Mountain and Pacific Census Regions.

Table 3D. REGIONAL 1990 SO_2 EMISSIONS FROM UTILITY BOILERS WITH 90 PERCENT FGD RELIABILITY[a]
(million tons)

	Level of Control				
			Full Control		Partial Control
	1975 Actual	Current Standards	90% Control With 240 ng/J Limit	90% Control Across Scrubber	240 ng/J Emission Limit
Total National Emissions	18.6	21.5	19.7	19.6	20.1
Regional Emissions					
East[b]	--	7.0	6.4	6.4	6.5
East South Central[c]	--	3.2	2.9	2.9	2.9
Midwest[d]	--	5.4	5.6	5.5	5.5
Great Plains[e]	--	2.4	2.3	2.3	2.4
West South Central[f]	--	2.2	1.6	1.6	1.8
West[g]	--	1.3	0.9	0.9	1.1
Total Coal Capacity (GW)	198	406	388	388	397

[a]Results of joint EPA/DOE analyses completed in November 1978 based on oil prices of $12.90, $15.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]New England, Middle Atlantic, and South Atlantic Census Regions.

[c]East South Central Census Region.

[d]East North Central Census Region.

[e]West North Central Census Region.

[f]West South Central Census Region.

[g]Mountain and Pacific Census Regions.

Table 4A. IMPACTS ON FUELS IN 1990 WITH 100 PERCENT FGD RELIABILITY[a]

	Level of Control				
			Full Control		
	1975 Actual	Current Standards	90% Control With 340 ng/J Limit	90% Control With 240 ng/J Limit	90% Control Across Scrubb
U.S. Coal Production (million tons)					
Appalachia	--	419	399	398	398
Midwest	--	348	390	390	390
Northern Great Plains	--	463	458	460	461
West	--	211	188	188	188
TOTAL	647	1441	1435	1436	1437
Western Coal Shipped East (million tons)	21	84	62	64	64
Oil Consumption by Power Plants (million bbl/day)					
Power Plants	--	1.8	2.0	2.1	2.1
Coal Transportation	--	0.1	0.2	0.1	0.1
TOTAL	3.1	1.9	2.2	2.2	2.2

[a]Results of EPA analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

Table 4B. IMPACTS ON FUELS IN 1990 WITH 100 PERCENT FGD RELIABILITY[a]

	Level of Control					
			Partial Control			
	1975 Actual	Current Standards	240 ng/J Emission Limit	90% Control With 330 ng/J Max. Control	Sliding Scale With 90% Control in West	240 ng/J Std. With 90% Control in West
U.S. Coal Production (million tons)						
Appalachia	--	419	412	415	411	411
Midwest	--	348	377	373	367	377
Northern Great Plains	--	463	455	451	465	459
West	--	211	200	202	196	197
TOTAL	647	1441	1444	1441	1439	1444
Western Coal Shipped East (million tons)	21	84	62	67	85	64
Oil Consumption by Power Plants (million bbl/day)						
Power Plants	--	1.8	1.9	1.9	2.0	1.9
Coal Transportation	--	0.1	0.1	0.1	0.1	0.1
TOTAL	3.1	1.9	2.0	2.0	2.1	2.0

[a]Results of EPA analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

Table 4C. IMPACTS ON FUELS IN 1990 WITH 100 PERCENT FGD RELIABILITY[a]

	Level of Control					
			Partial Control			
	1975 Actual	Current Standards	90% Control With 150 ng/J Max. Control	90% Control With 240 ng/J Max. Control	Sliding Scale With 390 ng/J Limit	95% Control With 520 ng/J Limit
U.S. Coal Production (million tons)						
Appalachia	--	419	403	406	410	403
Midwest	--	348	392	385	372	394
Northern Great Plains	--	463	445	451	465	465
West	--	211	199	199	198	188
TOTAL	647	1441	1439	1441	1445	1450
Western Coal Shipped East (million tons)	21	84	60	60	76	62
Oil Consumption by Power Plants (million bbl/day)						
Power Plants	--	1.8	1.9	1.9	1.9	1.9
Coal Transportation	--	0.1	0.1	0.1	0.1	0.1
TOTAL	3.1	1.9	2.0	2.0	2.0	2.0

[a]Results of EPA analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

Table 4D. IMPACTS ON FUELS IN 1990 WITH 90 PERCENT FGD RELIABILITY[a]

	Level of Control				
			Full Control		Partial Control
	1975 Actual	Current Standards	90% Control With 40 ng/J Limit	90% Control Across Scrubber	240 ng/J Emission Limit
U.S. Coal Production (million tons)					
Appalachia	--	419	398	398	411
Midwest	--	348	387	387	374
Northern Great Plains	--	463	460	459	450
West	--	211	183	184	202
TOTAL	647	1441	1428	1428	1437
Western Coal Shipped East (million tons)	21	84	65	64	63
Oil Consumption by Power Plants (million bbl/day)					
Power Plants	--	1.8	2.1	2.1	1.9
Coal Transportation	--	0.1	0.1	0.1	0.1
TOTAL	3.1	1.9	2.2	2.2	2.1

[a]Results of EPA analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

Table 5A. ECONOMIC IMPACTS IN 1990 WITH 100 PERCENT FGD RELIABILITY[a]
(1978 $)

	Level of Control			
		Full Control		
	Current Standards	90% Control With 340 ng/J Limit	90% Control With 240 ng/J Limit	90% Control Across Scrubber
Average monthly residential bills ($/month)	50.52	51.32	51.35	51.37
Incremental utility capital expenditures, cumulative 1976-1990 ($ billions)	--	2.5	2.4	2.5
Incremental annualized cost ($ billions)	--	1.9	2.0	2.1
Incremental cost of SO_2 reduction ($/ton)	--	1236	1041	1010

[a]Results of EPA analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

Table 5B. ECONOMIC IMPACTS IN 1990 WITH 100 PERCENT FGD RELIABILITY[a]
(1978 $)

	Level of Control				
		Partial Control			
	Current Standards	240 ng/J Emission Limit	90% Control With 330 ng/J Max. Control	Sliding Scale With 90% Control in West	240 ng/J Std. With 90% Control in West
Average monthly residential bills ($/month)	50.52	51.18	51.04	51.30	51.28
Incremental utility capital expenditures, cumulative 1976-1990 ($ billions)	--	5.5	4.8	4.1	6.0
Incremental annualized cost ($ billions)	--	1.5	1.1	1.8	1.7
Incremental cost of SO_2 reduction ($/ton)	--	955	1099	1014	958

[a]Results of EPA analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

Table 5C. ECONOMIC IMPACTS IN 1990 WITH 100 PERCENT FGD RELIABILITY[a]
(1978 $)

	Level of Control				
		Partial Control			
	Current Standards	90% Control With 150 ng/J Max. Control	90% Control With 240 ng/J Max. Control	Sliding Scale with 390 ng/J Limit	95% Control[b] With 520 ng/J Limit
Average monthly residential bills ($/month)	50.52	51.35	51.16	50.90	51.12
Incremental utility capital expenditures, cumulative 1976-1990 ($ billions)	--	6.4	5.5	5.1	5.5
Incremental annualized cost ($ billions)	--	1.8	1.4	0.7	1.3
Incremental cost of SO_2 reduction ($/ton)	--	1080	1090	2045	524

[a]Results of EPA analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]Modified FGD cost functions used.

Table 5D. ECONOMIC IMPACTS IN 1990 WITH 90 PERCENT FGD RELIABILITY[a]
(1978 $)

	Level of Control			
		Full Control		Partial Control
	Current Standards	90% Control With 240 ng/J Limit	90% Control Across Scrubber	240 ng/J Emission Limit
Average monthly residential bills ($/month)	50.52	51.34	51.36	51.23
Incremental utility capital expenditures, cumulative 1976-1990 ($ billions)	--	0.0	0.2	4.7
Incremental annualized cost ($ billions)	--	2.1	2.1	1.6
Incremental cost of SO_2 reduction ($/ton)	--	1171	1103	1115

[a]Results of EPA analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

Table 6A. SUMMARY OF 1995 IMPACTS WITH 100 PERCENT FGD RELIABILITY[a]

	Level of Control				
			Full Control		
	1975 Actual	Current NSPS	90% Control With 340 ng/J Limit	90% Control With 240 ng/J Limit	90% Control Across Scrubber
National Emissions (million tons SO_2)	18.6	23.7	20.5	19.8	19.5
New Plant Emissions[b] (million tons SO_2)	--	7.1	3.2	2.3	2.0
U.S. Coal Production (million tons)	647	1779	1765	1767	1768
Western Coal Shipped East (million tons)	21	122	59	77	77
Oil Consumption (million bbl/day)	3.1	1.3	1.7	1.7	1.7
Incremental Cumulative Capital Expenditures (1978 $ billion)	--	--	4.4	4.4	5.0
Incremental Annualized Cost (1978 $ billion)	--	--	4.1	4.3	4.3
Average Monthly Residential Bill (1978 $/month)	--	53.03	54.31	54.37	54.40
Total Coal Capacity (GW)	198	552	521	520	520

[a]Results of joint EPA/DOE analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]Plants subject to the revised standards.

Table 6B. SUMMARY OF 1995 IMPACTS WITH 100 PERCENT FGD RELIABILITY[a]

	Level of Control					
			Partial Control			
	1975 Actual	Current NSPS	240 ng/J Emission Limit	90% Control With 330 ng/J Max. Control	Sliding Scale With 90% Control in West	240 ng/J Std. With 90% Control in West
National Emissions (million tons SO_2)	18.6	23.7	20.3	21.2	19.9	20.0
New Plant Emissions[b] (million tons SO_2)	--	7.1	3.2	4.3	2.5	2.8
U.S. Coal Production (million tons)	647	1779	1765	1762	1769	1767
Western Coal Shipped East (million tons)	21	122	73	79	92	73
Oil Consumption (million bbl/day)	3.1	1.3	1.6	1.5	1.6	1.6
Incremental Cumulative Capital Expenditures (1978 $ billion)	--	--	5.9	3.7	9.0	7.4
Incremental Annualized Cost (1978 $ billion)	--	--	3.3	2.6	4.0	3.7
Average Monthly Residential Bill (1978 $/month)	--	53.03	54.08	53.84	54.34	54.24
Total Coal Capacity (GW)	198	552	534	537	531	533

[a]Results of joint EPA/DOE analysis completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]Plants subject to the revised standards.

Table 6C. SUMMARY OF 1995 IMPACTS WITH 100 PERCENT FGD RELIABILITY[a]

	Level of Control					
			Partial Control			
	1975 Actual	Current NSPS	90% Control With 150 ng/J Max. Control	90% Control With 240 ng/J Max. Control	Sliding Scale With 390 ng/J Limit	95% Control With 520 ng/J Limit[c]
National Emissions (million tons SO_2)	18.6	23.7	20.0	20.8	22.8	18.2
New Plant Emissions[b] (million tons SO_2)	--	7.1	2.6	3.7	6.0	1.6
U.S. Coal Production (million tons)	647	1779	1762	1765	1765	1799
Western Coal Shipped East (million tons)	21	122	68	69	83	54
Oil Consumption (million bbl/day)	3.1	1.3	1.6	1.6	1.5	1.5
Incremental Cumulative Capital Expenditures (1978 $ billion)	--	--	8.1	5.7	3.6	7.2
Incremental Annualized Cost (1978 $ billion)	--	--	4.0	3.1	1.9	0.8
Average Monthly Residential Bill (1978 $/month)	--	53.03	54.33	54.04	53.64	53.31
Total Coal Capacity (GW)	198	552	531	534	537	542

[a]Results of joint EPA/DOE analysis completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]Plants subject to the revised standards.

[c]Modified FGD cost functions used.

Table 6D. SUMMARY OF 1995 IMPACTS WITH 90 PERCENT FGD RELIABILITY[a]

	Level of Control				
			Full Control		Partial Control
	1975 Actual	Current NSPS	90% Control With 40 ng/J Limit	90% Control Across Scrubber	240 ng/J Emission Limit
National Emissions (million tons SO_2)	18.6	23.7	20.1	19.8	20.5
New Plant Emissions[b] (million tons SO_2)	--	7.1	2.4	2.1	3.2
U.S. Coal Production (million tons)	647	1779	1761	1762	1760
Western Coal Shipped East (million tons)	21	122	79	81	74
Oil Consumption (million bbl/day)	3.1	1.3	1.8	1.8	1.6
Incremental Cumulative Capital Expenditures (1978 $ billion)	--	--	3.5	4.2	5.2
Incremental Annualized Cost (1978 $ billion)	--	--	4.6	4.6	3.5
Average Monthly Residential Bill (1978 $/month)	--	53.03	54.46	54.47	54.14
Total Coal Capacity (GW)	198	552	520	520	534

[a]Results of joint EPA/DOE analysis completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

[b]Plants subject to the revised standards.

Table 7. SLUDGE GENERATED FROM UTILITY BOILERS[a]
(million tons/year dry basis)

NSPS Alternative	100% Reliability		90% Reliability	
	1990	1995	1990	1995
Current standard	17.7	23.0	--	--
90% control with 340 µg/J limit	33.?	55.1	--	--
90% control with 240 µg/J limit	33.3	53.7	32.2	52.1
90% control across scrubber	33.4	53.7	32.4	51.7
240 µg/J emission limit	27.4	41.5	26.1	39.3
90% control with 330 µg/J max control	25.7	38.1	--	--
Sliding scale with 90% control in West	29.0	47.3	--	--
240 µg/J standard with 90% control in West	28.8	43.5	--	--
90% control with 150 µg/J max control	31.5	49.6	--	--
90% control with 240 µg/J max control	28.4	43.4	--	--
Sliding scale with 390 ng/J Limit	25.5	39.5	--	--
95% control with 520 ng/J Limit	36.0	62.2	--	--

[a]Results of joint EPA/DOE analysis completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively.

TABLE 8. PRESENT VALUE OF INCREMENTAL UTILITY REVENUE REQUIREMENTS RELATIVE TO CURRENT STANDARDS[a]
(billions 1978 $)

NSPS Alternative	100% Reliability		90% Reliability	
	1990	1995	1990	1995
Current standard	--	--	--	--
90% control with 340 ng/J limit	21.9	41.4	--	--
90% control with 240 ng/J limit	21.8	43.4	23.5	46.2
90% control across scrubber	23.1	43.6	24.0	46.5
240 ng/J emission limit	16.5	33.0	17.9	34.7
90% control with 330 ng/J maximum control	12.9	25.8	--	--
Sliding scale with 90% control in West	20.1	39.7	--	--
240 ng/J standard with 90% control in West	18.9	37.3	--	--
90% control with 150 ng/J maximum control	20.7	40.0	--	--
90% control with 240 ng/J maximum control	15.8	31.2	--	--
Sliding scale with 390 ng/J limit	8.3	18.6	--	--
95% control with 520 ng/J limit[b]	14.7	10.4	--	--

[a]Results of joint EPA/DOE analyses completed in November 1978 based on oil prices of $12.90, $16.40, and $21.00/bbl in the years 1985, 1990, and 1995, respectively. Revenue requirements reflect total plant capital and operating costs including pollution control equipment.

[b]Modified FGD cost functions used.

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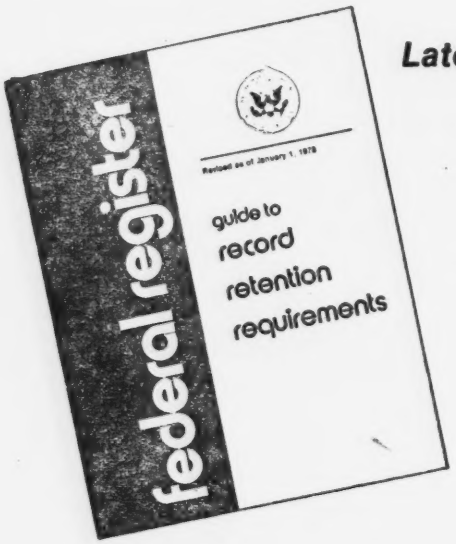

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